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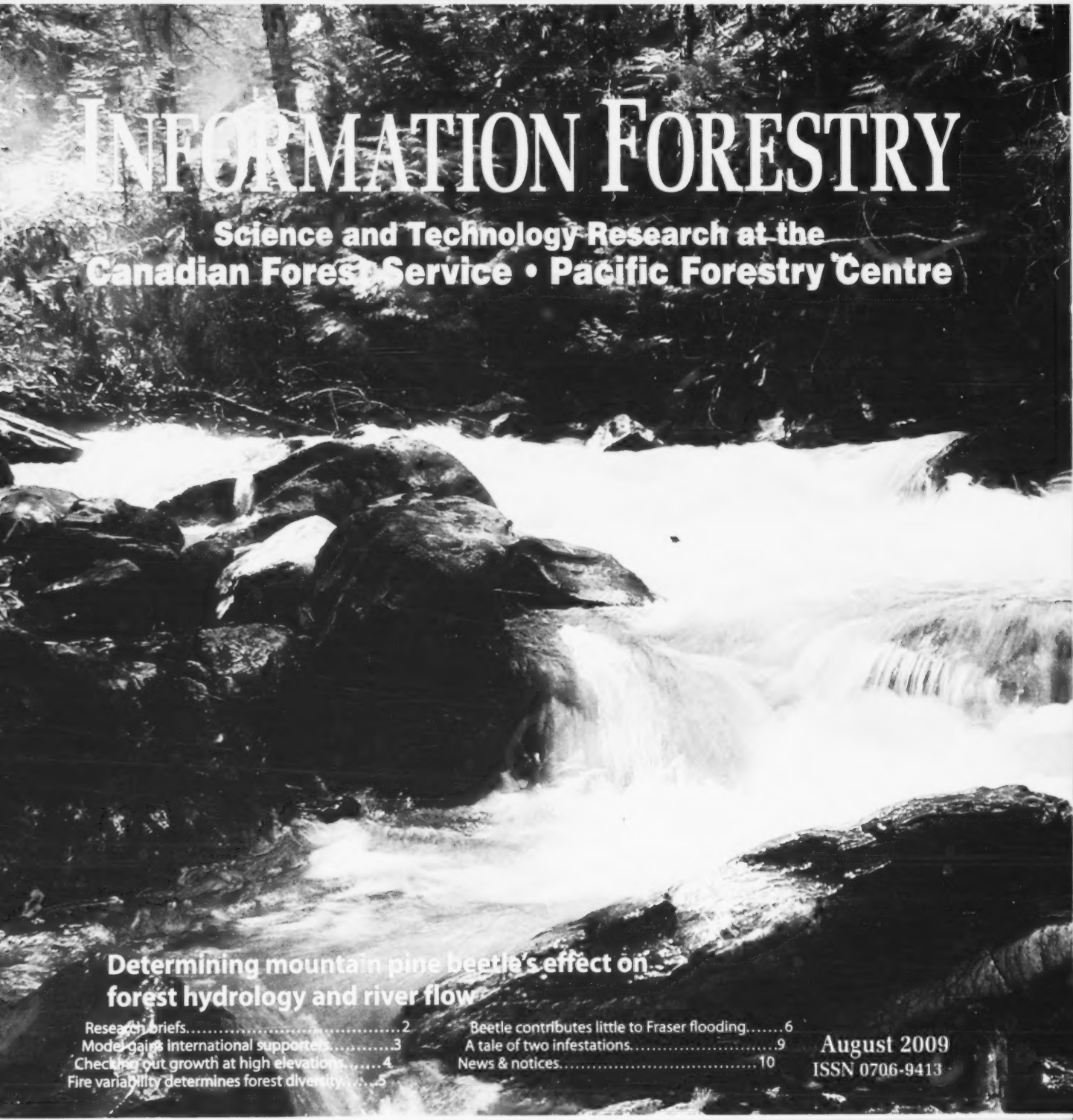

INFORMATION FORESTRY

Science and Technology Research at the Canadian Forest Service • Pacific Forestry Centre

Determining mountain pine beetle's effect on forest hydrology and river flow

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Canada

Weevil complicates post-beetle regeneration efforts

The mountain pine beetle infestation in British Columbia is pushing Warren root collar weevil from dying pine stands into nearby stands of young, regenerating pine. Photo by Matthew Klingenberg

A flightless, quarter-sized insect called Warren root collar weevil is complicating efforts to regenerate forest stands killed by mountain pine beetle.

"We find that 80 to 90 percent of cutblocks with young trees less than 10 years old are seeing some sort of mortality when located next to unsalvaged dead pine," says Natural Resources Canada Research Scientist **Brian Aukema** (brian.aukema@nrcan.gc.ca).

To better understand what is happening, Aukema and graduate student Matthew Klingenberg created an artificial plantation composed of dead and living lodgepole pine. They then painted numbers on the backs of hundreds of weevils, which are native to North American conifer forests, and released them. Each morning, they checked their traps and recorded the movement of individual weevils.

"Their movement rates are quite a bit higher in areas where there are dead trees than where there are live trees," Aukema says. The weevils prefer pine, so when faced with dwindling food within a forest attacked by mountain pine beetle, they migrate to neighboring areas offering new pine seedlings.

The weevil's larvae chew the base of the tree, creating tunnels that fill with resin that, when hardened, protects the grubs but chokes off the tree's vital water supply.

The team is looking for ways to prevent seedling mortality. The first step is to slow the weevil migration: a simple buffer zone of less-inviting host trees may limit the weevil's spread.

"Even if we could protect the pine for a year or two, that might be a fairly efficient control method," says Aukema. "This could significantly help the regeneration of beetle-killed pine stands."

With the current mountain pine beetle infestation expected to kill 80 percent of mature pine in British Columbia by 2013, forest regeneration will be a priority in the province for many years. –*NL*

Non-target moth and butterfly species recover four years post-spray

Moth and butterfly populations inadvertently affected during efforts to eradicate gypsy moth begin to recover a year after the last application of biological insecticide *Btk* (*Bacillus thuringiensis*, subspecies kurstaki). And, within four years, they are almost back to normal levels.

"The greatest impact on non-target *Lepidoptera* species appears to occur about one year after the last application of the insecticide," says Natural Resources Canada Research Scientist **Imre Otvos**, (imre.otvos@nrcan.gc.ca), who co-authored papers on this and other studies investigating non-target effects of *Btk*. *Lepidoptera* is the group of insects that includes moths, butterflies and their caterpillar young. "The affected insects begin to recover during the second year after application and, in most cases, in most species, the recovery is nearly 100 percent by the fourth year."

Researchers tracked moth and butterfly species numbers and diversity on Garry oak and snowberry before, during and after an aerial spray program by the British Columbia Ministry of Forests and Range to eradicate gypsy moth from the Victoria, British Columbia, area. Three applications of *Btk* were sprayed over 20 hectares in 1999, after a gypsy moth-monitoring program detected significant numbers of the non-native, damaging moth in the area.

The naturally occurring bacterium, *Bacillus thuringiensis* subspecies *kurstaki* (*Btk*) is the active ingredient of the biological insecticide used to eradicate the gypsy moth. *Btk* has been widely used as a biological pesticide in agriculture (including organic farming), forestry and urban parks for decades. Only moth and butterfly larvae that have alkaline guts and are feeding during *Btk* application and for three to five days thereafter are susceptible to the insecticide. *Btk* does not normally affect humans and other vertebrate animals, which have acidic stomachs.

See page 10 for more news about Btk *and gypsy moth in British Columbia.*

–*MK*

Source

"Recovery of nontarget lepidoptera on Vancouver Island Canada, one and four years after a gypsy moth eradication program" was published in *Environmental Toxicology and Chemistry*.

Carbon budget model gains international subscribers

Natural Resources Canada researchers developed the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS) to track the contributions Canada's managed forests make to the country's carbon balance and to help Canada meet its international reporting obligations. But now, other countries are adopting the model.

Dmitri Zamolodchikov, of the Russian Academy of Sciences' Centre for Problems of Ecology and Productivity of Forests, says working with the Canadian model benefits Russia's efforts to estimate forest carbon.

"Canada started earlier and has a working version of the model with a developed interface," he says. "So I ask myself why we need to go independently the whole way, because co-operation can facilitate the Russian ability to manage the carbon budget of forests."

In a joint collaboration, researchers from both countries tested the model using data from a seven-million-hectare forest management unit north of Moscow. The results of that study were published in 2008. Now, Russian researchers are running national-scale analyses covering 700 million forested hectares—twice the area of Canada's forest lands.

"There are many similar questions in both Russia and Canada," says Research Scientist **Werner Kurz** (werner.kurz@nrcan.gc.ca), leader of the Canadian Forest Service Carbon Accounting Team. "We've answered many of them, in terms of recognizing that the inventory and activity data that Russia has are compatible with what we do in Canada. That shows that the model is fairly adaptable and flexible."

According to Zamolodchikov, the model stands out among other ecosystem carbon models by being a "real 'forestry' model."

"It allows us to estimate the carbon budget of forest regions, taking into account past and current disturbances, age structure and management practices. Forest systems are good examples of 'emergence principles,' when new quantities appear with increasing scale. CBM differs from other ecosystem-level models in that it can 'catch' these emerging quantities."

Russia and Canada share similar forest types—they encompass 90 percent of the world's boreal forests—but countries with very different forests are also adopting the model. Under the Canada–Mexico Partnership, the Carbon Accounting Team and Mexican scientists are testing the model to assess how different future rates of deforestation will influence Mexico's greenhouse gas balance. Other countries, including Spain, are investigating the model for potential production of forest greenhouse-emissions and -removals estimates.

Russia is one of the first countries to adopt the Carbon Budget Model of the Canadian Forest Sector. Natural Resources Canada Physical Scientist Eric Neilson (left), Research Scientist Werner Kurz, and Computer Scientist Scott Morken (2nd from right) are joined at the Pacific Forestry Centre by Russian research scientists Vasily Grabovsky (middle) and Dmitri Zamolodchikov (right).

To deal with the forest ecosystems in warmer countries, Kurz says the model's parameters may need to be adjusted. "We've already done some preliminary work on simple questions like, What happens if you expose the model to mean annual temperatures of 30° Celsius instead of 3°? The model simulates processes that are temperature dependent, and if you increase temperature by a factor of 10, will these things blow up? The good news is they haven't. Early indications are that the model is providing reasonable results."

The model's reach extends further. It has been downloaded in 42 countries, and participants from 34 countries have attended CBM-CFS training workshops. As well, the Carbon Accounting Team regularly fields technical questions about the model from outside Canada.

While other countries clearly benefit from Canada's work on the model, sharing the CBM benefits Canada directly.

"The more other countries are willing to try it and use it, the more the model's science and parameters are scrutinized and tested," Kurz says. "That buy-in and understanding mean Canada can more easily defend its forest carbon estimates when we report internationally."

International use of the model enhances the credibility of the science and generates feedback about the model. This helps efforts to further improve the model. *–MK*

The Carbon Accounting Team produced a DVD with recordings and presentations of the March 2009 CBM-CFS training workshop. The DVD is available by request from Stephen Kull (stephen.kull@nrcan.gc.ca).

A pre-release copy of release 1.1 of CBM-CFS3 will be available for download from the web later this year.

Source

"CBM-CFS3: a model of carbon dynamics in forestry and land-use change implementing IPCC standards" was published in *Ecological Modelling*. Order a copy via the Canadian Forest Service online bookstore.

Growth check in high-elevation forests tied to nutrients

Harvesting and regenerating high-elevation coastal forests present unique challenges. The removal of forest cover may create such stressful environments that young trees cannot survive or that they grow so slowly that expectations for the future may be compromised.

To further complicate the issue, young seedlings may grow well for 5 or 10 years, then almost stop growing—what is called a growth-check response.

According to recent measurements from Vancouver Island's Montane Alternative Silvicultural Systems (MASS) research site, young amabilis fir trees that grew normally during their first decade on that high-elevation site have since slowed to a fraction of their previous growth rates.

"Perhaps after harvesting, the young seedlings experience a flush of nutrients as branches and needles decompose," says **Tom Bown**, Natural Resources Canada Canadian Wood Fibre Centre forest ecophysiology technician (tom.bown@nrcan.gc.ca). "Then all of a sudden the system seems to run out of gas and the trees just sit there."

The implications of growth check for forest inventory, growth and yield curves, and the economics of producing fibre in cold, high-elevation ecosystems could be profound.

"Growth check can be sudden and severe," says Research Scientist **Al Mitchell** (al.mitchell@nrcan.gc.ca), "in part because the number of trees on a site that exhibit the phenomenon seems to increase over time."

The slowing growth appears to be related to a combination of nutrient-poor soils and competition from other plants—in particular, from acidic-soil–loving ericaceous shrubs like blueberries, huckleberries, and other *Vaccinium* species.

"Because these shrubs are nitrogen sinks," says Research Biologist **Ross Koppenaal** (ross.koppenaal@nrcan.gc.ca), who works with Mitchell at the site, "they compete directly with trees by taking up nitrogen through massive rhizome systems. They also compete by producing phenolic compounds that bind with organic matter and contribute to the formation of a humus that limits nutrient availability to young, regenerating conifers."

Monitoring after the free-to-grow phase will help to locate stands that are going into growth check.

The Fibre Centre team is working to identify growth-check indicators and link them to site and stand characteristics. For instance, they've found that chlorotic, or yellowing, foliage, declining nitrogen concentrations in the needles, and extensive ericaceous-shrub cover coincide with the onset of slowed growth. The goal is to provide science-based tools to pinpoint the occurrence of growth check so that forest managers can better plan for the future.

After about one decade of promising growth, many young trees regenerating on high-elevation coastal sites seem to run out of nutrients and suddenly slow their growth. Researchers with the Canadian Wood Fibre Centre are trying to determine site and stand characteristics that will help forest managers predict this growth check.

Remotely sensed data reveal fire-variation impacts

Wildfire serves as a key agent of change and renewal within Canada's boreal forest. It clears vegetation and moss away to prepare seedbeds on which new forests regenerate. It controls local populations of insects. The heat of a forest fire helps regeneration by opening the serotinous cones of jack pine.

A study by Natural Resources Canada indicates how fire can also be a primary determinant of boreal forest structure and diversity. The information may lead to refined estimates of forest carbon losses due to fires, and to refined salvage harvesting and reforestation planning.

"Some people might think of the boreal as uniform, flat and boring," says Canadian Forest Service Research Scientist **Phil Burton** (phil.burton@nrcan.gc.ca), who, with Marc-Andre Parisien (parisien@nature.berkeley.edu), a CFS researcher on educational leave, led the study. "But when a fire burns through it, it creates different kinds of cover, habitat, and species assemblages that are important for birds, bears, caribou and everything else out there."

Burton and colleagues from the Canadian Forest Service, and Canadian and U.S. universities reviewed the fire-research literature, analyzed existing datasets such as the Canadian Forest Service's Large Fire Database, and examined new remotely sensed data about the boreal forest.

Out of that, Burton says, "We came up with new descriptions of regional variations and even of intra-fire variation in burn severity. It was something that hadn't been emphasized in the past: burns are not just one big, black scar on the landscape."

Forest fire consumes some areas of a forest completely. In other areas, trees may be killed by the fire, but the wood isn't consumed. Elsewhere, entire patches escape unharmed. The larger the fire, the greater the proportion of the fire's total footprint consists of these unburnt forest islands.

Documentation of internal fire-severity variation has implications for a range of forest values that extend well beyond timber yields. The green-tree islands act as refuges for wildlife and as seed sources for surrounding burnt areas. The variability also means Canada's forests may not be losing as much carbon into the atmosphere due to fires as estimated.

"This information may lead to more refined estimates of forest carbon losses," Burton says.

It may also help forest managers channel harvesting operations to areas where the wood is still good but the trees are dead, rather than harvesting green trees. And areas that are severely burned—where soil is no longer protected—are at risk of greater sediment runoff and erosion, and may be targeted for immediate reforestation. The information also provides guidance on how forest managers may best simulate natural disturbances in their harvesting plans.

The wealth of remotely sensed data on forests now available made the study possible.

"In the past, we would just draw a sketch map from an aircraft or maybe a few years later from an air photo, showing the extent of forest where trees were lost to fire," Burton says. "Now, we're able to much more accurately map out the exact geographical areas affected, and break them down by degrees of fire impact."

It illustrates how remote sensing is improving our understanding of the impact of forest fires across Canada, particularly in remote, inaccessible areas. Much of Canada's 300-million-hectare boreal forest falls into that category. *–MK*

Source

"Large fires as agents of ecological diversity in the North American boreal forest" was published in the *International Journal of Wildland Fire*. It can be downloaded from the Canadian Forest Service online bookstore.

The 1988 Coffee Fire burned thousands of hectares of boreal forest in northeastern Saskatchwan. The variability in fire intensity on the landscape subsequently determined the forest's overall structure and biodiversity.
Photo: Bill deGroot, CFS

Research determines mountain pine beetle's effects o

Key findings:

Riparian areas must be treated with care.

Risk of more-frequent flooding may increase in some localized areas.

Cumulative effect on larger-scale watersheds is minimal.

The mountain pine beetle epidemic in British Columbia has killed an unprecedented number of trees across the province's interior—the current estimate is 620 million cubic metres of timber. More than 14.5 million hectares of lodgepole pine forest have been affected. This large-scale timber mortality, combined with an extensive salvage harvesting program put in place to recover timber value, has led to a need to examine the potential implications of this level of forest disturbance for forest and watershed hydrology dynamics.

The Federal Mountain Pine Beetle Program, announced in 2007, has delivered a focussed research package intended to investigate the connection between hydrological processes and large-scale forest disturbances.

The first step was to synthesize related research that had been completed and to consult with sector stakeholders on their real-world experiences with post-beetle hydrology. It became apparent through these processes that information on the potential hydrological impacts of large-scale disturbances and their cumulative effects was lacking.

Using a hierarchical approach to identify information gaps and determine research priorities, the Program produced a suite of research and models that provide information on post-beetle hydrology impacts. This information will be used to complement forest policy and management decisions.

"Research completed under the Federal Mountain Pine Beetle Program gives us critical,

The mountain pine beetle epidemic in British Columbia currently comprises more than 14.5 million hectares of pine forest. Such large-scale natural disturbance and subsequent salvage havesting may affect hydrology locally and at the regional scale.

local hydrology and regional flood patterns

real-world, time-bounded information to support decision-making related to mountain pine beetle impacts and mitigation," says Allan Chapman, head of the British Columbia Ministry of Environment River Forecast Centre, and leader of one of the major hydrology research projects funded by the Federal Mountain Pine Beetle Program. "It provides us with quantitative, rather than qualitative or conjectural, information. This allows us to evaluate not only the direction of change as the beetle infestation progresses, but the potential magnitude of that change. This clearly helps water resource managers evaluate risk."

Studies led by researchers from universities, the province's Ministry of Environment and Ministry of Forests and Range, and the Canadian Forest Service, and funded by the federal beetle program, have produced the following key findings:

Riparian areas must be treated with care

It has long been known that ecosystems next to streams, lakes, and wetlands are especially sensitive to disturbance. Under the Federal Mountain Pine Beetle Program, researchers looked at the differences in function and structure in riparian areas within beetle-infested and non-infested stands, and within salvaged and unsalvaged stands.

One key finding of this research is the need to minimize the post-beetle management footprint within riparian zones. Previous research funded by the beetle program indicated that, due to the limited volume of pine in riparian zones, differences in function and structure between infested and non-infested stands is unlikely.

In order to better understand differences between salvaged and unsalvaged stands, researchers from the British Columbia Ministry of Forests and Range revisited hydrological data gathered before and after harvest following a major spruce beetle outbreak in the Bowron Lakes watershed in the early 1980s. This retrospective analysis revealed that indicators of riparian health can take longer than 30 years to recover to pre-harvest conditions after those riparian areas have been salvage harvested.

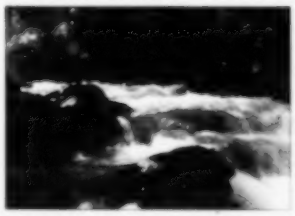
Scientists also concluded that if riparian areas are managed correctly, stream morphology will not change. In addition, infestation-induced wood transfer to stream and river channels during the next 25 years is likely to be relatively small and within the range of typical, regional conditions. This finding confirmed scientifically what had been previously observed, and supports the province's current riparian management area guidelines.

Risk of more frequent flooding in some localized areas may increase

At Baker Creek, a tributary of the Fraser River west of the town of Quesnel, University of British Columbia and Ministry of Forests and Range researchers collected hydrology and geomorphology stand-level data for integration into mid-scale watershed models. As they gathered information to strengthen the datasets, the researchers observed that extensive salvage harvesting in smaller watersheds could significantly impact many hydrological parameters in localized areas. Affected hydrological parameters might include amount and timing of peak flows.

(continued next page)

On the cover



The Federal Mountain Pine Beetle Program funded research to determine if and how the current mountain pine beetle epidemic and associated salvage logging affect hydrology.

Photo: kla4067 © 2009/flickr

Cumulative effect on larger-scale watersheds is minimal

Source

For more information about the Federal Mountain Pine Beetle Program, visit: mpb.cfs.nrcan.gc.ca

Mountain Pine Beetle Working Papers can be downloaded from the Canadian Forest Service online bookstore. New research reports on beetle-related hydrology will be posted to the bookstore as they are published.

Although 40 percent of the Fraser River Basin comprises beetle-killed forest, analysis of hydrology and stream-flow data from 60 sub-basins across the river's immense watershed indicates that most of the water that flows into the Fraser River during spring and early summer originates from higher elevations, where little pine grows.

Cumulative effect on larger-scale watersheds is minimal

About 40 percent of the Fraser River Basin comprises beetle-killed lodgepole pine forest. Communities and governments are concerned that this may mean the Lower Mainland will experience spring flooding because of the beetle infestation, and that flood protection measures within the basin may need to be improved.

Researchers from the British Columbia Ministry of Environment, the University of British Columbia, and the University of Victoria adapted a model developed at the University of Washington to link data from 60 sub-basins within the entire Fraser River watershed into a comprehensive beetle–hydrology risk-information framework. The framework permitted the researchers to assess stream-flow impacts for catchment areas of varying scales across the Fraser River watershed.

The scientists determined that a particular catchment area's sensitivity to beetle infestation and salvage harvesting varies spatially within the larger watershed. Catchments with low runoff ratios (ratio of amount of annual runoff to amount of annual precipitation), such as those within the Fraser Plateau in central British Columbia, appear to be very sensitive to forest disturbance.

Catchments with high runoff ratios, or with source areas with high runoff ratios, are much less sensitive to forest disturbance.

The peak flows of larger watersheds such as the Fraser River Basin depend largely on source areas with high runoff ratios. These areas typically comprise montane spruce and amabilis fir forests that grow at higher elevations and experience significant annual precipitation and deeper snow packs. The mountain pine beetle epidemic, however, is associated with submontane pine and Douglas-fir forests that grow at lower elevations and have drier climates and lower runoff rates.

Although the beetle infestation and its associated salvage harvesting can have a significant impact on the peak flows within smaller, localized watersheds, these forest disturbances have little effect on the cumulative downstream flows of the larger Fraser River system.

These key results provide immediate policy implications for resource managers.

For instance, Chapman says, "Program highlights include quantification of hydrologic changes anticipated for a range of rivers and watersheds throughout the beetle-affected areas, with varying forest stand types. This allows us to determine potential changes to flood risk for different communities throughout the region, and to evaluate and implement mitigation strategies."

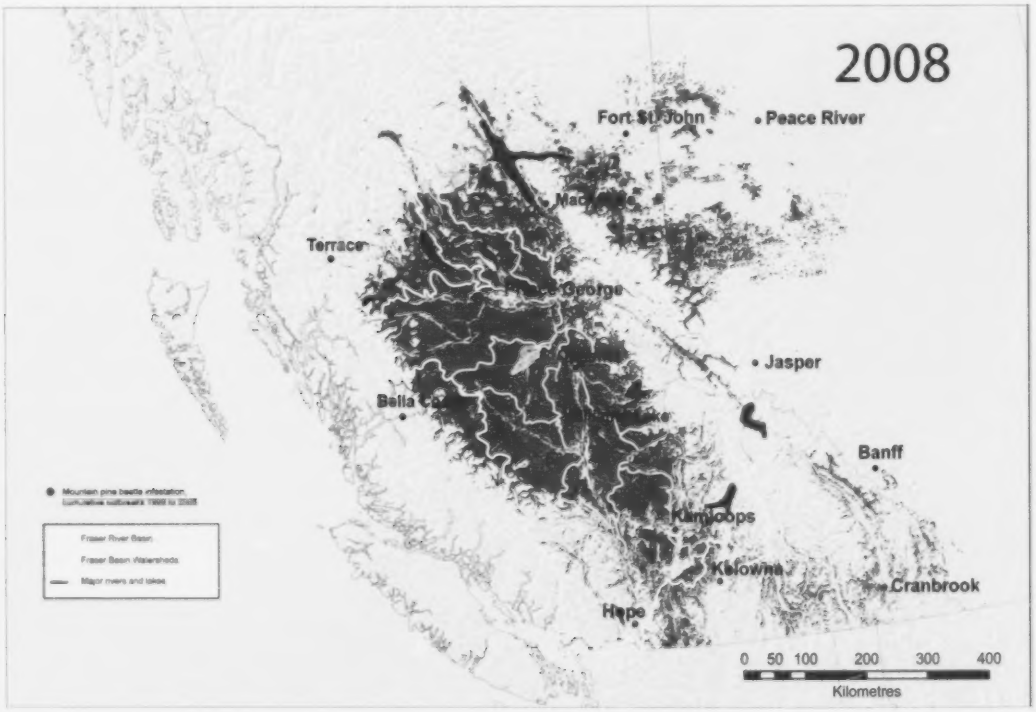
The Federal Mountain Pine Beetle Program will synthesize its findings in 2010.

–RP

Source

For more information about the Federal Mountain Pine Beetle Program, visit: mpb.cfs.nrcan.gc.ca.

Mountain Pine Beetle Working Papers can be downloaded from the Canadian Forest Service online bookstore. New research reports on beetle-related hydrology will be posted to the bookstore as they are published.



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Balancing damage and mitigation of two forest pests

Thinning undertaken in mixed lodgepole pine–Douglas-fir stands to control spread of mountain pine beetle currently has little effect on damage to Douglas-fir by western spruce budworm.

While the most extensive beetle epidemic in the province's history has been killing British Columbia's lodgepole pine forests, an overlapping budworm infestation has been stripping needles from another major timber species: interior Douglas-fir. Stands containing both species are common in the southern interior at the margins of Douglas-fir range, between elevations of 900 and 1100 metres.

According to a recent Natural Resources Canada study, forest managers can rest assured that if they selectively remove lodgepole pine from these mixed pine–Douglas-fir stands to reduce risk of mountain pine beetle attack, they won't be exacerbating the western spruce budworm infestation.

The study's results also suggest thinning in the province's Douglas-fir stands in general—not just that undertaken to control spread of mountain pine beetle—may help reduce losses in productivity due to damage by western spruce budworm.

"Spruce budworm doesn't cause spectacular tree mortality across a landscape the way mountain pine beetle does," says Canadian Forest Service Research Entomologist **Vince Nealis** (vince.nealis@nrcan.gc.ca), who led the two-year study on effects of mountain pine beetle mitigation on budworm damage to Douglas-fir. "It does, however, significantly affect tree growth and productivity."

Prior to the two-year study, called Balancing Natural Disturbances, information that confirmed whether management prescriptions undertaken to mitigate one pest problem—the beetle—would worsen or lessen western spruce budworm damage in mixed stands was lacking.

The researchers examined key processes that govern change in budworm population densities—whether budwom populations will rise or fall from generation to generation. Differences in two such processes became evident when Nealis and his research team compared thinned and unthinned stands.

In thinned stands, the researchers found fewer budworm larvae successfully survived spring-time dispersal to new host trees on which to feed.

"We expected that," says Nealis. "The larvae are floating around on threads, and if they are in a thinned stand, they have an increased chance of landing on the ground, rather than on a tree."

Once larvae disperse successfully and start feeding, natural enemies, predators, parasites and diseases begin taking their toll. Nealis and his team found the death toll from natural enemies was less in thinned stands than in unthinned stands. More pathogens, in particular, were present and killed far more larvae in the unthinned stands.

"The differences in the impacts of these two factors cancelled each other out, so the net result was thinning stands for beetle causes no difference in damage by budworm," says Nealis.

The level of mortality to spruce budworm from disease observed in the unthinned mixed stands was exceptionally high compared to observations elsewhere. Nealis and his team identified a virus from those stands that appears to be especially efficient at killing budworms.

"This pathogen seems to be more promising in terms of potential biological control than any other we've encountered in budworms," Nealis says. "We are now exploring that possibility." *–MK*

Source

"Balancing risks of disturbance from mountain pine beetle and western spruce budworm," published in the April 16 2009 issue of *The Canadian Journal of Forest Research*, can be downloaded from the Canadian Forest Service online bookstore.

Update:

Collaboration, community spirit vanquish gypsy moth

("Community delivers moth-eliminating alternatives," *Information Forestry*, December 2007)

The advent of an organic formulation of *Btk* (*Bacillus thuringensis*, subspecies kurstaki) that can be used to treat gypsy moth infestations has brought a three-year collaboration between Salt Spring Island residents and the British Columbia government to a successful close: the west coast island is now rid of the invasive, non-native insect.

"We succeeded in several ways," says Tim Ebata, of the British Columbia Ministry of Forests and Range. "Island residents are better informed about gypsy moth and its impacts, and better positioned to prevent infestations. And we are able to address concerns of organic growers in communities."

In 2006, when the province proposed aerially treating a gypsy moth infestation on Salt Spring Island with the standard *Btk* product then available, residents countered with a proposal to address the infestation in a way that protected the organic certification of local farms.

Under the proposal, resident-volunteers hunted egg masses, assembled moth traps, and hiked through bogs and bush to hang and later retrieve the traps. Meanwhile, provincially funded pest control staff hosed down trees and shrubs in the infested area with an older, water-based *Btk* product.

"Unfortunately, that product doesn't stick to leaves well, and it degrades quickly when exposed to sunlight," says Ebata, "so it is less effective than the forestry formulation we normally would use."

Nonetheless, progress was made every year.

But the manufacturer of Foray 48B™, the *Btk* product used in aerial sprays, delivered the infestation's final blow in 2008 when the company released an organically acceptable version of the product. When sprayed over the infestation, the new product eliminated all surviving gypsy moths.

The island's experience proves collaboration can meet diverse objectives, says Natural Resources Canada's **Vince Nealis** (vince.nealis@nrcan.gc.ca). "When people are informed of the risks and are willing to discuss approaches that benefit communities and the environment at large, science, policy and local interests can be compatible and effective."

To remain gypsy moth-free, island residents must be vigilant. The invasive moth moves into new areas by hitchhiking as eggs attached to vehicles and other outdoor goods brought from infested areas. The island's moth control proposal includes building ongoing awareness of the issue, and encouraging residents to report suspected egg masses, larvae and moths. *–MK*

Events

National Forestry Week
September 20–26
Events across Canada
Information: cfs.nrcan.gc.ca/events/87

2009 AGM and Conference
Canadian Institute of Forestry
September 21–23
Nanaimo, BC
Information: vancouver-island@cif-ifc.org

Exploration and Discovery: Past, Present and Future
National Science and Technology Week
October 16–25, 2009
Events across Canada

2009 Joint Annual Meeting
Entomological Society of Canada and Entomological Society of Manitoba
October 18–22
Winnipeg, MB
Information: www.esc-sec.ca/annmeet

XIII World Forestry Congress
October 18–25
Buenos Aires, Argentina
Information: www.wfc2009.org

Trends and Opportunities
Canadian Forest Communities Conference 2009
November 4–7
Nanaimo, BC
Information: www.fcc-ccf.ca/html/home_e.html

Pest Management Forum 2009
December 1–3
Gatineau, Quebec
information: stan.phippen@nrcan.gc.ca

People

Arrivals

Prior to his appointment as the new National Programs Database Administrator at the Pacific Forestry Centre, **Kristian Arndt** worked for the National Forest Inventory as a Java and web-applications software developer. In his new role, he is responsible for architecting and maintaining Oracle and PostgreSQL databases for national programs at the centre.

Meghan Noseworthy was recently appointed Research Biologist, Insectary Diagnostics, working with Research Scientist Lee Humble in the Forest Health Section at Pacific Forestry Centre. Before this appointment, Noseworthy held several term biologist positions at the centre. Her research this year focuses on invasive insects—in particular, wood-borers and using pheromone lures for insect detection and surveillance.

Bark Beetle Ecologist/Forestry Officer **Greg Smith** joins the Pacific Forestry Centre's bark beetle research group. With his 2008 degree in Natural Resources and Environmental Studies from the University of Northern British Columbia, Smith studies mountain pine beetle population dynamics, with a focus on endemic, incipient beetle populations. He is also looking into secondary bark beetle infestations.

Michael Magnan was recently appointed Computer Scientist, Carbon Budget Modelling, for the Canadian Forest Service Carbon Accounting Team. Magnan helps to develop, maintain, and extend Carbon Accounting software solutions and infrastructure. He first worked with the team as a student in 2002, and has also worked with Convedia Systems, Burnaby, and Dai Nippon Insatsu, Tokyo.

Also joining the Carbon Accounting Team at Pacific Forestry Centre is Scientific Model Applications Computer Programmer **Gary Zhang**. Zhang is developing a new web-based application for the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS). He first started working with the team in 2003.

Departures

After 12 years at the Pacific Forestry Centre, mountain pine beetle expert and Research Scientist **Allan Carroll** has taken an assignment as Associate Professor with the Department of Forest Sciences, Faculty of Forestry, at the University of British Columbia. There, Carroll will be building a research program to assess the impacts of climate change on forest insect disturbances.

Head of Scientific Publications **Steve Glover** celebrated 27 years of editing and writing at the Pacific Forestry Centre by putting aside his red pencil and retiring this spring. Glover was instrumental in the development of the Canadian Forest Service online bookstore and its supporting databases.

Research Scientist **Alan Thomson** retired this spring. During his three decades at the Pacific Forestry Centre, Thomson helped develop community forest management tools, forest health information systems, decision support systems, and web-based workshops for adaptive environmental management.

Afforestation and Carbon Accounting Physical Scientist **Thomas White** is now Manager of Water and Air Monitoring and Reporting at the British Columbia Ministry of Environment. As a member of the Canadian Forest Service Carbon Accounting Team, White helped develop a database of afforestation activities in Canada, and researched requirements for the afforestation module of Canada's National Forest Carbon Accounting System.

Accolades

Congratulations to the six most recent recipients of the Pacific Forestry Centre Graduate Student Awards.

The University of British Columbia contributed four of the award winners. Colin Ferster continues his work with Research Scientist **Tony Trofymow** using inventory-based attributes to characterize carbon stocks within eddy-flux co-variance tower footprints. Research Scientist **Mike Wulder** supervises Samuel Coggins on integrating multi-scale remotely sensed imagery with ground-survey information to provide forest inventory data. Jeremy deWaard, with Research Scientist **Lee Humble**, is monitoring biodiversity responses to natural and anthropogenic disturbances in British Columbia's forests through the application of DNA barcoding. Robbie Hember is examining forecasting changes in the carbon cycle of British Columbia forests under climate and disturbance scenarios with Research Scientist **Werner Kurz**.

Two award recipients from the University of Victoria are supervised by Research Scientist **Mike Wulder**. Nicholas Gralewicz is investigating national fire susceptibility assessment using data from the Earth Observation for Sustainable Development of Canada's Forests (EOSD) program, and Jed Long is quantifying the spatial pattern in forests impacted by mountain pine beetle and its management.

New from the bookstore

Mountain Pine Beetle working papers

Assessing the shelf life attributes of mountain pine beetle-killed trees. 2009. S. Magnussen; D. Harrison. Mountain Pine Beetle Working Paper 2008-27.

Linking survey detection accuracy with ability to mitigate populations of mountain pine beetle. 2009. S. Coggins; M.A. Wulder; N.C. Coops; J.C. White. Mountain Pine Beetle Working Paper 2008–28.

Change in wood quality and fall rate of trees up to ten years after death from mountain pine beetle. 2009. K.J. Lewis; D. Thompson. Mountain Pine Beetle Working Paper 2008–30.

Proposed protocol for evaluating potential strength-reducing characteristics in lumber after a catastrophic event: Pilot application and next steps. 2009. C. Lum. Mountain Pine Beetle Working Paper 2009–01.

Proposed protocol for assessing and responding to lumber strength-reducing characteristics associated with a catastrophic regional event: Addendum to Mountain Pine Beetle Working Paper 2009-01. 2009. C. Lum. Mountain Pine Beetle Working Paper 2009–01.1.

Quality assessment for structural lumber from mountain pine beetle-attacked timber: Data analysis. 2009. P. Trott; C. Lum. Mountain Pine Beetle Working Paper 2009–02.

Forecasting mountain pine beetle-overwintering mortality in a variable environment. 2009. B.J. Cooke. Mountain Pine Beetle Working Paper 2009–03.

Other

Environmental Science Advisory Committee: 2007 Annual Report. 2009. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre. Co-published by the Department of National Defense.

Tenure and the management of non-timber forest products in British Columbia. 2008. S. Tedder. Sustainable Forest Management Network, Edmonton, Alberta.

Measuring our progress: Putting sustainable forest management into practice across Canada and beyond. 2008. Canadian Council of Forest Ministers, Ottawa.

Mesurer nos progrès : Mise en oeuvre de l'aménagement durable des forêts au Canada et à l'étranger. 2008. Conseil canadien des ministres des forêts, Ottawa.

Annual economic review and outlook for the Canadian forest sector: 2008-2009. 2008. Natural Resources Canada, Canadian Forest Service, Ottawa.

Danger trees in your community. Helping to keep mountain pine beetle-affected communities safe. Fact Sheet. 2008.

Canadian forest genetic resources information system CAFGRIS (Poster) (Système d'information sur les ressources génétiques forestières canadiennes CAFGRIS (Affiche)). 2009.

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